

Software System Requirements

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1. SOFTWARE STRUCTURE

- a. *Expansion with minimal change to RSMS-4G software code:* The data acquisition and processing software will be capable, with a minimal amount of change to **RSMS-4G code**, of expansion by adding new measurement routines, new pieces of equipment, and new pieces of information to the data output file.
- b. *Flexible System Hardware Configuration:* The system will be capable of controlling and acquiring data with many different hardware configurations (front-ends, antennas, measurement equipment, and paths). The user will have the option of overriding the automated control and, therefore, manually controlling certain pieces of equipment along the signal processing chain; however, if the piece of equipment is available for query, the program will determine the state and record it in the data file, irrespective of whether it was manually or automatically set up.
- c. *Grandfathering of data structures:* Analysis and processing routines will be capable of processing different versions of data-file structure (all **RSMS-4G**) such that analysis /processing is tailored to the specific structure at hand using only the latest versions of the processing software.

2. CAPABILITIES

- a. *Measurement Types:* Data acquisition and processing capabilities will be developed as described in the Functional Measurement Requirements document. These routines will be developed in order, according to the level of assigned priority.
- b. *Diversity of Measurement Equipment:* The data acquisition software will be programmed to perform the same basic measurement types with different types of equipment (e.g., different spectrum analyzer models). The software will be designed in such a way that adding new models of the same type of equipment will require minimal changes to the existing **RSMS-4G code**.
- c. *Modes of data acquisition:* The data acquisition software will be capable of acquiring data in each of the following modes:
 - i. **Fully automated:** the computer automatically acquires data from the terminal piece of equipment.
 - ii. **Data dumps:** the system and terminal device is configured either automatically, semi-automatically, or manually, and the user acquires and records - in the standard RSMS-4G file format - data that is either displayed on the monitor of the designated terminal piece of equipment or is digitized by an ADC.
 - iii. **Manual entry:** the user reads values from a measuring device and enters these values for storage using the standard RSMS-4G file format.
- d. *Calibration, corrections, and tuning*
 - i. **Automated calibration:** the software will have the capability for automatic, as well as, manual system calibration for magnitude and/or phase in specified regions of the spectrum. The system will also have the

- capability for manual entry of calibration factors in table.
 - ii. **Time scheduled, incident driven, or manually instigated calibration:** calibrations will be instigated either automatically at specified time-intervals/incidents, or manually by the user.
 - iii. **Recording of system calibration:** The most recent system calibration will be stored in each data file. Any subsequent calibration will be inserted into the file prior to any further measurements.
 - iv. **Recording of system configuration:** System configurations will be stored in the data file whenever possible.
 - v. **Automated YIG tuning:** any system with external YIGs will be tuned using a fully automated routine (but also provide a manual tuning capability). The YIG tuning will be instigated either automatically at specified time-intervals/incidents, or manually by the user. This routine will also have the option for locking the YIG into specific center frequencies and/or frequency offsets during the course of spectrum analyzer frequency sweeps.
 - vi. **Characteristics of devices:** The software will make provisions for storing characteristics of specific devices such as noise diodes, log amp, and antennas so that the information may be called upon automatically when performing calculations.
- e. *Measurement replay:* the software will provide the user with the capability of examining data and then executing data acquisition using the same system setup as documented in the data file.
- f. *Band event and channel event capabilities:* the software will provide the capability for defining band and channel events - where band events define the measurement setup and measurement type for one measurement procedure within a band, and channel event defines the measurement setup for a measurement type at each channel within a band.
 - i. **Storage of events:** the software will provide the user an easy means for entry and editing of event characteristics. Events will be stored in file for future reference.
 - ii. **Sequencer:** the software will provide the user an easy means for entry and editing of sequenced events to be interpreted by the software for sequential execution of measurements described by the events.
 - iii. **Scheduler:** the software will provide the user an easy means for entry and editing of scheduled events to be interpreted by the software for execution of measurements described by the events and triggered by time, incident, or position.
- g. *Graphical system setup:* the software will provide a graphical means for the user to choose the instruments, devices (e.g., noise diodes, filters, amplifiers, log amps) and connection associated with a specific measurement. This feature will be available irrespective the mode of measurement (fully automated, semi-automated, screen dump, or manual entry) and will also be utilized for setting up band and channel events.

- h. *Automated system query and call to appropriate software module*: After the graphical system setup is entered, the software will determine, through automatic queries as to whether the appropriate equipment is available. The software will then utilize the appropriate software module specific to the type of equipment.
 - i. *Overload detection*: the software will provide a mechanism for detection of compression, and 3rd order intermodulation distortion.
 - j. *Digitization of baseband, IF, and RF signals*: the capability for digitizing baseband, IF, and RF signals will be developed to meet the requirements of both real-time and post-acquisition digital signal processing capabilities as described in the Functional Measurement Requirements document.
 - k. *Examination and plotting*: Software will provide the capability to examine, plot and/or print raw and limited processed data in the field
 - l. *ASCII file output*: The software will have the capability of writing data to ASCII files if chosen by the user.
 - m. *Online Help*: The software will provide online help.
 - n. *Documentation*: In addition to in-line code comments, documentation will be provided in the form of a user manual describing operation.
3. **SYSTEM CONTROL OPTIONS**: the following mechanisms for system setup and control will be available:
- a. *Manual*: the user manually controls all equipment settings along the signal processing chain.
 - b. *Semi-automated*: the user controls certain pieces of equipment along the signal processing chain, and the computer (or other device) automatically controls the terminal device and certain other determined pieces of equipment.
 - c. *Fully-automated*: all devices along the signal process chain are controlled automatically via computer (or other controlling device).
 - d. *Conditional*: the type of measurement and system setup are determined by a condition - either time, incident (e.g., rain), or position (e.g., GPS coordinate)
 - e. *Sequenced*: the control and setup of equipment is determined by the specifications as defined in band or channel events . Execution of the events is determined by sequential ordering.
 - f. *Scheduled*: the control and setup of equipment is determined by the specifications as defined in band or channel events . Execution of the events is determined by sequential ordering, as well as, triggering by time, position, or incident .
 - g. *Script Language*: the software will provide a mechanism for using simple script language (entered in ASCII text) to customize measurements. This will require the design of the script language format and development of a mechanism for reading, interpreting, and executing the commands.
 - h. *Remote*: System control is provided from a remote location.
4. **DEVELOPMENT AND DOCUMENTATION**: software modules will be developed and documented using Unified Model Language.